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HYPNUM UNCINATUM Hedw., var. *SUBJULACEUM* Sch., forma **Holzingeri** Ren.—Forme voisine de la forme *orthothecioides* Lindb.; en diffère par la couleur verte, les touffes compactes encombrées de terre à la base, l'acumen plus court denticulé et le tissu plus délicat, non épaissi.—Base of Sperry glacier.

Minor extensions of range will be noted in a fuller report on this collection.—JOHN M. HOLZINGER, *Winona, Minn.*

EXPLANATION OF PLATE XI.

(Nacht's objectives 3 and 6, oculars 1 and 3, with camera lucida. All drawings are reduced $\frac{1}{4}$ in photo-engraving.)

1. *Dicranoweisia subcompacta*. *a*, entire plant, nat. size; *b*, *b*, *b*, leaves, $\times 32$; *c*, basal areolation $\times 135$; *d*, marginal areolation in the middle $\times 135$; *e*, point of a leaf $\times 135$.

2. *Grimmia Holzingeri*. *a*, entire plant, nat. size; *b*, *b*, *b*, *b*, leaves $\times 32$; *c*, basal areolation $\times 285$; *d*, marginal areolation in the middle $\times 285$; *e*, transverse section of a leaf $\times 285$.

3. *Barbula rufipila*. *a*, *a*, leaves $\times 13$; *b*, areolation in the upper part $\times 285$; *c*, the same of *B. aciphylla* from a specimen of Styria $\times 285$.

4. *Hypnum Cardoti*. *a*, entire plant, nat. size; *b*, *b*, *b*, leaves $\times 32$; *c*, marginal areolation in the middle $\times 285$; *d*, capsule $\times 13$.

NOTES OF TRAVEL. III.

RIO AND PETROPOLIS, BRAZIL.

To a professional traveler and to a botanist Rio de Janeiro and Petropolis have more to offer than any other easily accessible place in South America. Mr. Barbour Lathrop, with whom the writer has the pleasure of traveling as assistant, is familiar with many of the picturesque spots in the world, and even to him the region about Rio was a most agreeable surprise.

We visited together in 1897 the harbor of Sydney, Australia, which is most commonly compared with that of Rio, and were able to draw comparisons which are decidedly favorable to Rio.

Sydney harbor is long and, in comparison with that of Rio, narrow, with a great number of small coves separated by sharp points of land which jut out into the stream. These points of land, each side of the harbor, alternate with the coves opposite, like the teeth of a shark. These low and rounded hilly points are covered with Australian

scrub, which is composed of narrow-leaved acacias, eucalyptus, and numerous Myrtaceæ of a gray-green color. To those who tire of the gray-green of Italian olive groves, these narrow-leaved Myrtaceæ soon become monotonous, and the scanty shade shed by the sickle-shaped vertical leaves of the eucalyptus makes little in the landscape that is restful to the eye. There are scarcely any islands in Sydney harbor, and its principal charm to a traveler lies in these innumerable coves which on either hand pop into view from the steamer. They are often filled with shipping, and the shores are being rapidly denuded of their forest and scrub vegetation, though many quiet pretty views still remain. A botanist finds in the curious Proteaceæ, the most peculiar grass trees (*Xanthorrhoea*), and the endless variety of Myrtaceæ a host of forms which tickle his morphological sense with their novelty.

Rio harbor, on the other hand, is like a large inland lake, with numerous islands scattered through it, and surrounded by tall curiously rounded sugar-loaf hills. Islands, hills, and low-lying swampy shores are covered with a wealth of tropical vegetation quite as luxuriant as any to be seen directly under the equator. In place of the rounded gray-green of the hills of Sydney, Rio has dark imposing cliffs which reach above the low-lying clouds. Their deep ravines and valleys are a tangle of creepers, bright purple flowered melastomas, broad-leaved lilies, and innumerable epiphytic bromelias. Everything is steaming with moisture and the leaf tips are dripping with dew.

The islands in the harbor, though very picturesque, lack both cocoanut palms and coral reefs, two features which give to the islands of the south seas their peculiar charm. The former lack could easily be remedied, but the brilliant white coral reef would be difficult to supply.

Rio is the most picturesque city in South America. The Portuguese architecture is a great relief after the monotony of Spanish American cities, and no suburb in any city that I know is more charming than Botafogo, the residence portion of Rio. Each picturesque house, of yellow or pink stucco, trimmed with colored Moorish tiles and roofed with red tiling, is set in a half-neglected garden of tangled flowering creepers, bamboos, ficus trees, and foliage plants. Although not as well taken care of as the American gardens of Honolulu, they are much more numerous and picturesque. In fact, I do not believe there is a place in the world where such an array of picturesque gardens and houses can be seen as here in Rio.

The characteristic feature of Rio vegetation is made by the avenues of royal palms. Although there are avenues of this palm in Java, Hawaii, Jamaica, Trinidad, and Ceylon, in none are they really impressive. The first leaf-sheath in young plants is always objectionably prominent. The immense avenues of Rio are so tall that these leaf-sheaths are not noticeable. No more beautiful avenues of palms are imaginable than those of the Botanic Gardens and a double avenue near Botafogo.

The Botanic Garden lies an hour's train ride from the center of the city, in a locality unfortunately infested with yellow fever. Its most courteous director, Dr. Rodrigues, has made a special study of palms, and his collections are very tastefully arranged through the garden. Although containing many rare specimens, this collection does not compare in any respect with that in the gardens of Java or Ceylon. Owing to its situation so far from comfortable hotels and its lack of laboratory facilities, the garden will be a difficult place in which to prosecute botanical studies. In the winter months the danger from yellow fever would quite prohibit its being used except for a few hours a day, as no stranger who values his life risks living in the city, but spends his nights at least either at Petropolis, three and one half hours away, or at Tijuaca, much nearer, but not so free from fever.

The charm of Rio, botanically, is in its surroundings. Petropolis, a city of twenty thousand inhabitants, lies at an altitude of three thousand feet among the mountains across the bay from Rio, and is reached by two hours of ferryboat and railway travel. During the season of yellow fever, from January to June, over two hundred passengers, mostly business men, make this trip twice a day, leaving Petropolis every morning and returning in the evening. As the danger from yellow fever is only incurred by exposure to the night air, Europeans live in perfect security by making their homes in Petropolis and never spending a night in Rio during its summer season.

The ride to Petropolis is richer in panoramic effect than any road of like length in the tropics, surpassing the famous railway journeys from La Guayra to Caracas in Venezuela, Columbo to Kandy in Ceylon, and from Padang to Padang Pandjang in west Sumatra. The vegetation near the shore of the harbor, through which the railway passes, resembles that of the dense swamps characteristic of the isthmus of Panama—a paradise for the collector of fresh water algæ, but infested with malaria. These low lands are covered with a tangled

jungle of ferns, convolvulus, bananas, and flowering lilies, enlivened by occasional characteristic melastomas, one blaze of dark purple flowers. As the train climbs the steep incline and the cogs of the miniature engine grasp the cog rail a panorama of increasing grandeur is unrolled. It comprises the whole harbor with its dark green islands and surrounding densely forest-clad mountains. * Dark green cliffs, covered everywhere with masses of creeping plants, tower above the train, their tops concealed by low-lying clouds. At one point a deep narrow valley spreads out into the plain below and from the train one looks down upon square miles of tropical tree tops of various shades of green.

The evidences of intense insolation in the deep reds and bright yellows of the young foliage are few as compared with west Java, Sumatra, or Trinidad, and the occasional white foliage of a species of Araliaceæ remind one of the candle nut trees (*Aleurites*) in the Hawaiian landscapes. In the early morning a sea of clouds shuts out the view of the harbor and replaces it with a most curiously effective scene.

Rio is the largest city of Europeans within the tropics, and upon Petropolis, its fashionable suburb, has been expended, in beautiful villas and gardens, the wealth and taste of its most successful merchants. The climate is that delightful one characteristic of the high altitudes in this latitude. Cool, even cold, nights and bright warm days mark the winter, with occasional cloudy weather and frequent showers. In summer there is almost perpetual, sometimes uncomfortably warm, sunshine but with always cool nights. During our stay in May, corresponding to our autumn, the nights were cold, the mornings crisp and cool, and midday was never uncomfortably warm.

The forests immediately surrounding Petropolis are a second growth. Within easy walking distance, however, there are large stretches of virgin forest, with jungles in which climbing bamboos, tree ferns, purple flowering melastomas, begonias, occasional epiphytic orchids and phyllocactus, and an abundance of bromelias and lianas make up the undergrowth between the immense forest trees of Myrtaceæ and Ficus. The roadsides are lined with thickets of native raspberries, bearing attractive bright red but insipid fruit. The walls of the embankments are covered with mosses, filmy ferns, lichens, and liverworts, with occasional polypodium. The light gray trunks of the forest trees are spotted with bright red patches formed by a species of

lichen, and the branches of the trees are thick with fern, bromelia, and moss epiphytes, characteristic of moist tropical mountains. The sunny clearings in these forests are simply alive with brilliant butterflies, and here and there across the paths are files of the leaf cutting *Atta* ants, which Belt and Möller have so well described. Patches of Cuphæa by the roadside are especially subject to the attacks of these interesting leaf cutters, and their intelligent movements as they cut and carry the leaves and tender stems to their nests are perfectly fascinating and worthy a much more serious study than has so far been given them. Beaten paths cleared of all dead leaves and fragments of stone can be traced for many yards through the forest, leading to the openings of the nests, down which in endless streams the busy cutters tumble leaf fragments, which they have brought balanced between the spines of their thoraci.

A few inches beneath the surface of the ground these leaf fragments are masticated and molded into the sponge-like mushroom-bed upon which the fungus grows that forms the "*kohl rabi*," which is the necessary food of the species. A one sided warfare is waged against these attas by a powerful species of black ant, over half an inch long, and my friend and I watched with keen interest the slaughter of a dozen or so of the leaf cutting workers by a single one of these assassins, who killed every individual he found, as a terrier would a rat.

Although there are no laboratory facilities of any kind in Petropolis, its natural advantages for a botanist are exceptional. Proximity to the virgin forests, a climate in which one can work as comfortably as in New England, the most beautiful scenery imaginable, and a large and highly intellectual society of Europeans, make it a place without equal in the mountains of the tropics. Living in the hotels *en pension* would amount to about \$2 a day for all expenses. A bicycle could be used to excellent advantage in making excursions along the country roads, which are very good in the neighborhood of the town. Excursions to Cascatina, Itymarati, and the Organ mountains are full of the liveliest interest, and an abundance of material for morphological and biological studies can be easily gathered together.

The Corcovado is a tall mountain overlooking Rio, from which a view of unparalleled interest is obtainable and Tijuaca is a small village lying in the cul de sac between the hills behind it. The latter is surrounded by dense forests, which are penetrated by many miles of well kept wagon road, forming doubtless the most extensive natural

park of its kind in the tropics. Rio being the railway center of Brazil, excursions to the interior are made with comparative ease.

To any botanist who wishes to study tropical vegetation, and who has at the same time an eye for the beautiful, Petropolis and the other suburbs of Rio will prove beyond question the most attractive place in the world. As compared with the mountains of Java or Sumatra they are civilized, have a much more salubrious climate, and all the conveniences of modern civilized life. The south island of Hawaii or the south Pacific islands have no such stretches of virgin forest, nor such a flora or fauna to explore. Ceylon is hot and uncomfortable in comparison, and the mountains of Jamaica and Trinidad are uninhabited except by scattered planters.

It is the writer's belief that there is no other place in the world where such a combination of tropical vegetation, wonderful scenery, civilization, and cool equable climate can be found.—D. G. FAIRCHILD, *Port Said, Egypt*, September 21, 1899.

ANOTHER NOTE ON THE FLOWER VISITS OF OLIGOTROPIC BEES.

SINCE the table in the BOTANICAL GAZETTE 28:36 was published, *Andrena arabis* has been found collecting pollen of *Cardamine rhomboidea*. In the second column, therefore, Cruciferae should be substituted for *Arabis laevigata*.

Of the three species of *Calliopsis* enumerated on page 28 of the same volume, one, *C. andreniformis*, is quite polytropic. Another, *C. coloradensis*, I think, is oligotropic and gets its pollen exclusively from Compositae. It collects pollen of *Boltonia asteroides* and *Coreopsis aristosa*.

A male of the third species was taken on August 23, 1897, on flowers of *Verbena stricta*. I did not care to describe it until I had found the female. July 15, 1899, the sexes were taken in copula on flowers of *Verbena urticifolia*, the females collecting the pollen. The males were also taken on *V. hastata*. In the mean time, the bee was taken in New Mexico on flowers of *V. macdougalii* by Miss Porter, and was described by Cockerell under the name of *Calliopsis verbenae*. This author says nothing about it collecting the pollen. The bee is evidently an oligotropic visitor of Verbena.—CHARLES ROBERTSON, *Carlinville, Illinois*.